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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/771,728	02/04/2004	William Infantolino	END920010110US2 (15013A)	4047
23389	7590	07/27/2005	EXAMINER	
SCULLY SCOTT MURPHY & PRESSER, PC 400 GARDEN CITY PLAZA SUITE 300 GARDEN CITY, NY 11530			TRAN, LONG K	
			ART UNIT	PAPER NUMBER
			2818	

DATE MAILED: 07/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/771,728

Applicant(s)

INFANTOLINO ET AL.

Examiner

Long K. Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 04 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1 - 7 and 15 - 20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 - 7 and 15 - 20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 February 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 2/4/04, 3/21/05
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Response to Preliminary Amendment***

1. This office action is in response to Preliminary Amendment filed on February 04, 2004:
2. Claims **8 – 14** have been cancelled.
3. Claims **1 – 7** and **15 – 20** are presented for examination.

### ***Information Disclosure Statement***

4. This office acknowledges of the following items from the Applicant:  
Information Disclosure Statements (IDS) filed on February 04, 2004 and March 21, 2005.

The references cited on the PTO -1449 form have been considered.

### ***Oath/Declaration***

5. The declaration filed on February 04, 2004 is acceptable.

### ***Drawings***

6. The drawings are objected to because: character **24** designated to the corner of the substrate in figures 1 and 3 is a typo error. It should be **22** (see specification page 7, line 1). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet,

and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Specification***

7. The specification has been checked to the extent necessary to determine the presence of possible minor errors. However, the applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

8. IN THE SPECIFICATION:

Page 1: add --Now US Patent No. 6,747,331-- at the end of paragraph added by the applicant preliminary amendment filed on February 04, 2004.

### ***Claim Rejections - 35 USC § 103***

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims **1 – 7** and **15 – 20** are rejected under 35 U.S.C. 103(a) as being unpatentable over Murayama (US Patent No. 6,303,998) in view of Kodnani et al. (US Patent No. 6,596,559) or The Applicant Admitted Prior Art (AAPA).

Regarding claims **1** and **15**, Murayama discloses an electronic package 14 (figure 3) comprising: providing a square or rectangular semiconductor chip 12 (figures 3, 5(a) – 5(c); column 1, line 58 – 60) mounted on a substrate 10 (figures 3, 5s0(a) – 5(c)) having edge portions forming at least one corner point; the square substrate 10 having edge portions forming at least two corner point at distal edge portions thereof; whereby the at least one corner point of the at least one semiconductor chip is angularly rotated about a z-axis through a neutral point (chip center) relative to the two corner points of the substrate subtending a predetermined angular displacement between the corner points of the substrate (see **Note 1**) and the at least one corner point of the at least one corner point of the semiconductor chip so as to reduce warpage between the semiconductor chip and the substrate caused by thermally-induced stresses generated therebetween at the corner points (see **note 2**).

**Note 1:** (Murayama, figures 3, 5(a) – 5(c) illustrates the semiconductor chip 12 rotates around a perpendicular axis (z-axis) at the neutral point (central point) of the semiconductor chip 12 and of the substrate 10 relative to the two corner points of the substrate).

**Note 2:** Murayama does not explicitly point out the warpage caused by thermally-induced stresses generated therebetween at the corner points. However, figure 2 (c) illustrates the semiconductor device 14 (without rotating (inclining) the semiconductor

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chip 12) having corner points (far ends) of substrate 10 being bent after completing the cool-down cycle by thermally-induced stresses generated therebetween at the corner point (column 2, lines 41 – 59 and column 3, lines 15 – 17 and lines 25 – 30).

Murayama fails to teach the substrate being an organic substrate.

However, organic material is conventionally used in semiconductor art, specifically in flip-chip art, for making a substrate, as shown by Kodnani et al (Col. 6, lines 66 – 67 and column 7, lines 1 – 4 or the AAPA (page 1, lines 23 – 25 and page 6, lines 15 and 16).

It would have been obvious to one of ordinary skill in the art at the time tile invention was made to use polymer as shown by Kodnani et al. or the AAPA for making the substrate in Murayama device In order to provide enhanced adhesion at the under-fill and substrate interface (Col: 6, lines 66 – 67 and column 7, lines 1 – 4).

Regarding claims 2 and 16, the combination of Murayama in view of Kodnani or AAPA shows at least one solder joint array 16 (AAPA, page 6, line 17) is provided between the at least corner point B (AAPA, figures 1 and 3) of the at least one semiconductor chip 12 (AAPA, figures 1 and 3) and the organic substrate 10 (AAPA, figures 1 and 3), the at least one solder joint array corner point C (AAPA, figures 1 and 3) being in superimposed alignment with the at least one corner point A (AAPA, figures 1 and 3) of the at least one semiconductor chip (Murayama, figures 3, 5(a) – 5(c); column 5, lines 22 – 30). **Note 3**, semiconductor chip 12 being inclined to have the corners being offset angularly relative to the substrate corners).

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Regarding claims **3** and **17**, the combination of Murayama in view of Kodnani or AAPA shows the at least one corner point on the at least one semiconductor chip is rotated in the z-axis through the neutral point from at least one corner point on the organic substrate by an angular displacement of about  $45^{\circ}$  (Murayama, figures 3, 5(a) – 5(c) illustrates the semiconductor chip 12 rotates around a perpendicular axis (z-axis; also shown in the AAPA figures 1 – 3), at the neutral point (central point) of the semiconductor chip 12 and of the substrate 10 relative to the two corner points of the substrate).

Regarding claims **4** and **18**, the combination of Murayama in view of Kodnani or AAPA shows a thermally curable adhesive underfill material 18 (Murayama, figures 7(a) – 8) is provided between the at least one semiconductor chip 12 (Murayama, figures 7(a) – 8) and the organic substrate 10 (Murayama, figures 7(a) – 8), whereby cooling of the underfill material or thermal cycling of the electronic package generates stresses causing warpage between components of the package (Murayama. Column 2, lines 28 – 59).

Regarding claims **5** and **19**, the combination of Murayama in view of Kodnani or AAPA shows silicon chip 12 having CTE of  $3 \text{ ppm}/^{\circ}\text{C}$  (AAPA, page 1, lines 22 – 24)

Regarding claims **6** and **20**, the combination of Murayama in view of Kodnani or AAPA shows the polymer substrate comprising laminate such as an epoxy having CTE of about  $18 \text{ ppm}/^{\circ}\text{C}$  (AAPA, page 1, lines 23 – 25).

Regarding claim **7**, the combination of Murayama in view of Kodnani or AAPA shows the neutral point (central point) B (Murayama, figure 2(c); column 3, lines 5 – 18)

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coincides with the center point of the semiconductor chip, and Murayama, figure 2(c), shows a maximum bending shear deformation of the electronic package occurs at least at one corner point of the organic substrate distance from the neutral point (central point) B (Murayama, column 3, lines 15 – 17 and lines 25 – 30).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Long K. Tran whose telephone number is 571-272-1797. The examiner can normally be reached on Mon-Thu.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on 571-272-1787. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LKT

July 22, 2005

